Supply, Workload and Utilization: A Population-Based Analysis of Surgery in Rural Manitoba

LESLIE L. ROOS, JR., PHD

Abstract: This paper explores the relationships among physician supply, workload (output per physician), and utilization (physician services per capita) in rural Manitoba. Surgery taking place within a patient's home area and that taking place outside this area are discussed. Longitudinal and cross-sectional analyses are compared.

Although the average surgeon does more surgical procedures than does the average general practitioner, the number of procedures performed varies greatly within each specialty. Individual physician workloads remained fairly stable over time when a surgically active physician moved into an area, while population utilization increased 17 per cent. When such physicians left an area, the surgical workloads of the physicians increased significantly (18.7 per cent) while population utilization stayed essentially the same. Both physician workload and surgical utilization in control areas increased gradually (between 6 and 7 per cent) over the period studied.

Several models of physician behavior were investigated using data on individual procedures as well as overall figures. A model emphasizing the importance of physician discretion appeared to provide the best fit with the data. (*Jm J Public Health* 1983; 73:414–421.)

Introduction

Considerable recent literature deals with the relationships between physician supply, on the one hand, and physician workload (output per physician) and population utilization (physician services per capita) on the other.[1] Despite some contradictory evidence,[2] most North American studies have indicated surgical utilization tends to vary with supply factors.[3] Such research has typically been cross-sectional, using regression analyses to estimate the effects of such variables as number of surgeons (or physicians) on surgical utilization.[4,5]

Rates and types of surgery also vary across medical market areas with similar numbers of specialists and general practitioners.[6] Such variation appears due to differences in practice styles among physicians, rather than to random variations in morbidity[7] or to characteristics of the populations of the different areas.[8,9]

This paper uses data from Manitoba, one of ten Canadian provinces. Manitoba surgical rates for different procedures are generally near the median of age and sex standardized rates for Canada.[3] The Manitoba data permit considering the frequency of surgery longitudinally, looking at small area physician supply, physician practice patterns, and population utilization. In the words of Hughes *et al*,[10] this paper analyzes the "dynamics of the delivery of surgical services," focusing upon changes in workload and utilization when a surgically active physician moves into or out of a small area.

Materials and Methods

This paper defines physician surgical workload and population surgical utilization as follows:

Physician Surgical Workload—The number of surgical procedures done by a physician in a year

Population Surgical Utilization—The number of surgical procedures/1000 population in a hospital service area

This research uses a quasi-experimental methodology,[11] focusing upon changes in existing practice patterns and utilization when a surgically active physician moves into or away from an area. Workload and utilization data one year before the arrival or departure of such a physician are contrasted with this information one year after the date. Other areas not characterized by such an event serve as controls. Information from Manitoba residents aged 25 and

Address reprint requests to Leslie L. Roos, Jr., PhD, Faculties of Administrative Studies and Medicine, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada. This paper, submitted to the Journal January 19, 1982, was revised and accepted for publication July 12, 1982.

© 1983 American Journal of Public Health

over and living outside the two urban centers of Winnipeg and Brandon is analyzed here.*

Fifty-seven rural medical market areas have been defined, using the criterion that at least 30 per cent of the residents hospitalized in 1971 were admitted to the hospital(s) within their home area. For these areas, the median percentage of patients hospitalized within their area facility was 57.3 per cent. These areas include all rural hospital areas excluding Indian reserves and the urban areas of Brandon and Winnipeg. Most areas (defined using rural municipality boundaries) contained only one hospital, but some had two hospitals located in adjacent towns such that the catchment areas overlapped significantly. The population of these areas totaled 33 per cent of Manitoba residents and 87 per cent of the residents in non-urban areas.

Data are obtained from discharge claims filed routinely by hospitals with the Manitoba Health Services Commission. Universal hospital insurance has been operating in Manitoba since 1958. The quality of information taken from these health insurance claims, particularly the completeness and reliability of surgical data, is excellent. For example, 97 per cent of hospital records involving hysterectomies correctly matched the surgeon's claim, with identical procedures noted in 95 per cent of the cases.[12]

In Manitoba, as is true of most of Canada, very few specialists practice outside of the larger urban centers. American studies counting the supply of surgeons in small areas are of less relevance in Manitoba where so much minor surgery and even some major surgery is done by general practitioners. Manitoba physicians of the same specialty vary greatly in the quantity of surgery they do. Since one general practitioner may differ markedly from another in the amount of surgery performed, the regression analyses used in other studies are less appropriate than quasi-experimental methods designed to better capture the details of rural practice.

In this research, physicians are assigned to "home areas" on the basis of patient place of residence. Almost all rural physicians practiced at a hospital located in their home area, the area in which the plurality of their patients resided. On the average, approximately nine times as many operations were performed by rural physicians on home area residents as on residents of the "next most frequent area." Patient border-crossing is explicitly treated by presenting both the workload and utilization analyses in "in home area" and "outside home area" terms. Because considerable surgery on rural residents takes place in Brandon and Winnipeg, such utilization is an important component of the population-based rates.

Physician Variation

Although general practitioners predominate in rural areas, the average surgeon generally performs more operations than does the average general practitioner. These figures were relatively stable from 1974 through 1978. Table 1 presents basic statistics for these specialties; the median rural surgeon in 1977 performed 239 operations annually on home area patients and 73 operations on patients living outside the home area. The amount of surgery done by these physicians varied widely—from 1 to 407 procedures annually in the home area. Considerable surgery is also done by general practitioners. As seen in Table 1, general practitioners performing 20 or more operations made up a substantial portion of the rural general practitioners.

Complexity of surgery can be estimated by dividing the total hernia equivalent (HE) scores for a physician's inpatient and outpatient operations by the number of such operations.[10] Higher scores mean more complex operations.** Surgeons had mean hernia equivalent scores of .88. General practitioners averaged .41, while GPs doing 20 or more primary operations averaged .47. A small N may cause an unstable HE score; a physician who operates infrequently might perform one or two procedures one year with a total hernia equivalent of two or three and a single relatively easy operation (with an HE score of less than one) the next year. These mean hernia equivalent scores proved relatively stable from year to year for physicians doing 20 or more procedures annually.

Medical Market Areas

Rural medical market areas are characterized by a high level of year-to-year consistency in the amount of surgery performed. For 1974 and 1975, small area surgical rates correlated .84. Year-to-year product moment correlations for rates of surgery done within the area and rates for that done outside (primarily in Winnipeg and Brandon) were even higher; the correlations were both .92. Surgery for an area's residents can be separated into that done by "permanent" physicians—those remaining within an area for a period of years—and that performed by new registrants and more transient physicians. Dividing the physician supply into two groups permits concentrating on permanent physicians, operationally defined as those physicians having the same home area for the 1974–1978 period. These physicians typically perform between 60 and 70 per cent of the surgical procedures done in their home areas. The consistency of their year-to-year workloads (autocorrelations always over .85 and generally over .90) underlie the correlations found for small area utilization.

Change and Constancy

Rural medical market areas are studied here under three conditions:

1. when a surgically active physician or physicians (doing a total of 50 or more operations in the year of arrival) enters an area (defined as arrival areas);

2. when a surgically active physician or physicians (doing a total of 50 or more operations in the year of departure) leaves an area, retires, or dies (defined as departure areas);

*Because surgery on individuals under age 25 is not included, some types of operations—particularly tonsillectomy/adenoidectomy—are underrepresented.

**This index is standardized on inguinal hernia repair (1.0). Other common procedures and their scores are as follows: dilation and curretage of the uterus (.43), hemorrhoidectomy (.86), and cholecystectomy (1.7).

TABLE 1—Adult Surgical Workloads of Surgeons and General Practitioners in Rural Areas (1977)*

	Surgeons (N = 13)			
	Procedures Performed			
	Mean	SD	Median	Range
In Home Area Surgery	197.5	128.3	239.0	1–407
Outside Home Area Surgery	86.4	103.9	73.0	0–397
Total Surgical Procedures	283.9	215.7	312.0	1–752
	General Practitioners (N = 240)			
	Mean	SD	Median	Range
In Home Area Surgery	71.6	64.4	54.2	0–341
Outside Home Area Surgery	26.6	25.7	21.2	0–146
Total Surgical Procedures	98.2	82.2	84.0	1–397
	General Practitioners Doing 20 or More Primary Operations (N = 105)			
	Mean	SD	Median	Range
In Home Area Surgery	123.4	60.7	109.0	20–341
Outside Home Area Surgery	41.3	28.2	32.4	8–146
Total Surgical Procedures	164.7	75.2	142.0	35–397

*Physicians were counted only if they performed at least one surgical procedure of some type during the year.

3. when no such changes occur (defined as control areas).

Physicians seldom move from one rural area to another; physicians coming to rural Manitoba are primarily new registrants—new graduates or practitioners from other Commonwealth countries. Doctors leave rural Manitoba for the urban centers of Brandon and Winnipeg, for other North American locations, and through retirement or death.

Areas where two or more entering or departing physicians did 50 or more surgical procedures were treated in the same manner as areas where this many procedures were performed by a single new practitioner. Areas with one surgically active physician entering and another leaving in the same year (with no net gain of 50 or more operations) were included among the controls. The overall physician supply was reasonably stable, a prerequisite for analysis of changing workloads. Change in surgical supply was operationalized in several alternate ways; the conclusions did not change.

Seven small areas with surgically active physicians entering during one of two adjacent years in the study period were identified. Information from each area was adjusted to produce the appropriate before year, year of arrival, and after year. A similar adjustment was made for the six areas where a surgically active physician departed. Since the control areas had no parallel to "year of arrival" or "year of departure," data from the four relevant years (years 1 through 4) are summarized for these areas. Per cent change for control areas was calculated by averaging the year one-year three and year two-year four changes.

Results

Setting up Practice and Leaving

During the mid 1970s, between 60 and 80 newly registered physicians moved into the rural medical market areas each year. Only one of the physicians moving into the seven "arrival" areas was not a new registrant; ten new physicians doing surgery (seven of whom performed 50 or more home area operations in the year of arrival) entered these areas over the two years. Thus, the surgically active physicians made up a relatively small proportion of the new practitioners going to rural areas. The total number of operations done by these surgically oriented physicians increased from a mean of 88.2 procedures in the year of their arrival to one of 133.4 procedures the following year. Because physicians move at various months during the arrival year, their performing more surgical procedures the year after the move is to be expected.

During the mid 1970s about a half a dozen operating physicians moved annually from a rural area to another part of Manitoba. Physicians who "deregistered" (left Manitoba, retired, or died) were a greater source of change. During the relevant years, from 40 to 60 rural physicians were deleted from the registry each year.

Active Physician Arrives

The arrival of a surgically active physician did not significantly reduce surgical workload in these affected ar-

TABLE 2—Adult Surgical Workload of Permanent General Practitioners—Arrival, Departure, and Control Areas*

Arrival Areas (N = 21 General Practitioners in 7 areas***)	Mean Number of Procedures**			
	Year before Arrival	Year of Arrival	Year after Arrival	Per Cent Change
In Home Area Surgery	107.7	111.1	107.0	−0.6
Outside Home Area Surgery	26.7	27.3	24.3	−9.0
Total Surgical Procedures	134.4	138.4	131.2	−2.4
Departure Areas (N = 27 GPs in 6 areas)	**Mean Number of Procedures**			
	Year before Departure	Year of Departure	Year after Departure	Per Cent Change
In Home Area Surgery	71.3	77.4	85.6	20.1
Outside Home Area Surgery	18.4	19.5	21.0	14.1
Total Surgical Procedures	89.7	96.9	106.5	18.7
Control Areas (N = 77 GPs in 45 areas)	**Mean Number of Procedures**			
	Year One	Year Two	Year Three	Year Four	Per Cent Change
In Home Area Surgery	90.0	88.6	96.8	93.2	6.4
Outside Home Area Surgery	38.8	39.0	42.0	42.2	8.2
Total Surgical Procedures	128.8	127.6	138.8	135.5	7.0

NOTE: For the control areas, an averaged comparison is made. Year one is compared with year three and year two is compared with year four. Results are then averaged.

*Physicians were counted only if they performed at least one procedure of some type during each year.

**Surgical procedures include all ICD-8 numeric operation codes except those for normal deliveries (numeric codes 750, 751, 753 through 756, and 759).

***One area had a departure, followed by an arrival the next year and was counted in both categories. Results were similar when this area was excluded.

eas, but this arrival may have kept workloads from increasing in line with the overall trends in the control areas. Table 2 presents data for general practitioners in arrival, departure, and control areas. Including the four permanent surgeons in the arrival areas and four in the control areas increased the mean workload by from 10 to 15 operations per year without affecting the overall trends. Data for diagnostic procedures and deliveries were generally similar. Means varied relatively little through the years; neither the place of residence of patients having surgery nor the type of procedures changed markedly over this period. All year-to-year workload correlations (for surgery, diagnostic procedures, and deliveries) were .85 or over; most were greater than .90.*** The year-to-year differences in workload means were statistically significant (using a t-test) for only one comparison, that between the second and third years for the controls.

Individual elective procedures were also examined, although a high percentage of all procedures (about 45 per cent) are performed in urban areas on rural residents. Year-to-year product moment correlations were substantial across the three types of areas, with the highest correlations (between .88 and .95) for the procedures most frequently done by rural practitioners on adults (D&C and cholecystectomy).

***Diagnostic procedures include all ICDA alphabetic codes; normal deliveries include numeric codes 750, 751, 753 through 756, and 759.

Active Physician Departs

Parallel analyses were performed for general practitioners remaining in areas from which a surgically active doctor had departed; only one permanent surgeon practiced in these areas. Table 2 shows substantially different results for the departure areas.

First, an increase in workload appears to be associated with the departure of an active physician. The increase for surgical procedures was 8.1 per cent for the year before-departure year comparison and 9.9 per cent for the departure year-year after comparison. Given the small N, year-to-year differences were not statistically significant, but the overall year before-year after difference of 18.7 per cent was significant at the .02 level. This mean increase in the departure areas differs substantially from that in the control areas (average two year increase of 7.0 per cent).

Either overall trends or physician supply changes might affect the type, as well as number, of operations performed. An analysis of hernia equivalent workloads gave results generally similar to those based on counts, but the percentage changes are not as great. A 6.7 per cent increase in hernia equivalent workloads for departure areas (from 38.9 in the year before to 41.5 in the year after) compares with a

TABLE 3—Adult Surgical Rates—Arrival, Departure, and Control Areas

Arrival Areas (N = 38,328 Individuals over 25)	Rates per Thousand: Year before Arrival	Year of Arrival	Year after Arrival	Per Cent Change
In Home Area Surgery	10.43	11.65	12.62	21.0
Outside Home Area Surgery	7.15	7.31	7.92	10.8
Total Surgical Procedures	17.57	18.96	20.56	17.0
Departure Areas (N = 35,817 Individuals over 25)	**Rates per Thousand: Year before Departure**	**Year of Departure**	**Year after Departure**	**Per Cent Change**
In Home Area Surgery	13.20	13.55	12.65	−4.2
Outside Home Area Surgery	5.73	5.78	6.05	5.6
Total Surgical Procedures	18.93	19.35	18.74	−1.0

Control Areas (N = 128,091 Individuals over 25)	Rates per Thousand: Year One	Year Two	Year Three	Year Four	Per Cent Change
In Home Area Surgery	9.79	10.08	10.35	10.26	3.8
Outside Home Area Surgery	8.01	8.59	8.93	9.26	9.7
Total Surgical Procedures	17.79	18.67	19.30	19.52	6.6

NOTE: All rates are age- and sex-adjusted. The total surgical rates will sometimes differ very slightly from the sum of the "in home area" and "outside home area" rates.
For the control areas, an averaged comparison is made.

0.3 per cent decrease for control areas and a 3.3 per cent decrease for arrival areas.

Although workloads in the arrival and control areas were generally similar, the workloads of permanent physicians in the departure areas were lower than those elsewhere. When "permanent physician" is redefined on a three-year, rather than a five-year, basis the workload differences among types of areas are lessened considerably. Eight more general practitioners are added to the totals for the departure areas; these physicians had average total workloads of 162 procedures in the before year. The two three-year practitioners added to the arrival areas had mean total workloads of 92 procedures in the before year. Including these physicians changes the before workloads to 130.7 procedures for the arrival areas and 106.2 procedures for the departure areas.

Statistical regression to the mean might possibly have been responsible for the before-after workload increases for the five-year permanent physicians, but this appears implausible for several reasons. Areas were selected according to physician arrival or physician departure, not according to the other doctors' surgical workloads. The high autocorrelations for workload (upper .80s or .90s) suggest minimal measurement error and thus little regression to the mean. Furthermore, the operative workloads of surgically active permanent physicians in departure areas showed no statistical tendency to regress to the mean of doctors elsewhere. Although scores for general practitioners with little surgical activity moved upwards toward the mean (from 38.7 procedures before to 44.8 procedures after, N = 14), scores for active practitioners also increased, moving away from the overall mean (from 144.5 procedures to 173.0 procedures, N = 13).

Changes in Population Utilization

Table 3 shows the changes in patient surgical utilization associated with the arrival or departure of a physician performing a large number of operations, as well as the trend for control areas. These data suggest the increased utilization associated with the arrival of a surgically active physician. The supply of permanent physicians is relatively small (21 general practitioners plus four surgeons for the seven arrival areas); a number of these physicians do relatively little surgery. The relative constancy of the workloads of both permanent and other physicians confirmed the importance of the arriving physician.

All seven arrival areas show an increase, statistically significant at the .01 level using the binomial theorem. Utilization in the departure areas drops slightly (1.0 per cent), with four out of six areas showing a decrease. The control areas' increase averages 6.6 per cent for the two year comparisons, with 31 out of 45 areas registering an increase (significant at the .02 level using a normal curve approximation). Given the large numbers of cases, overall changes in rates between the arrival areas and control areas, and between departure areas and control areas, differed significantly at the .01 level (comparing a z statistic with the normal curve value).

Arrival areas experience a 21.0 per cent increase in such surgery compared with a 4.2 per cent decrease for departure

TABLE 4—Physician Supply before Arrival or Departure of Surgically Active Physicians

	Mean Number of Operating Physicians	Mean Number of Physicians	Mean Operating Physicians/1000 Individuals over 25	Mean Physicians/ 1000 Individuals over 25
Arrival Areas (N = 7 areas)	6.86	8.14	0.69	0.82
Departure Areas (N = 6 areas)	9.50	10.17	0.85	0.91
Control Areas (N = 45 areas)	4.24	4.38	0.82	0.85

areas and an average 3.8 per cent increase for the control areas. However, "outside home area" surgery does not drop for the arrival areas. Indeed, operations of this type increase somewhat (10.8 per cent) in the before-after comparison. Such operations also increase in both control areas (9.7 per cent) and departure areas (5.6 per cent).

Comparing Tables 2 and 3 shows that, despite the generally lower workloads among permanent physicians in the departure areas, overall surgical rates were similar among the three types of areas. This seeming anomaly comes about because, given our definition of permanent physicians, permanent physicians performed a smaller portion of the operations in departure areas than in other areas. Thus in one typical year, the proportion of surgery done by physicians remaining in departure areas for five or more years was 44 per cent; comparable figures were 72 per cent for arrival areas and 62 per cent for control areas. When permanent physicians were redefined as those practicing in the area for three or more years (rather than for five), differences in the proportion of surgery done narrowed considerably; the range was from 67 per cent in departure areas to 77 per cent in arrival areas.

Individual Procedures

Fries has suggested that changes in population utilization accompanying the arrival or departure of a surgically active physician should be approached at the level of the individual procedure, rather than at a more aggregate level.‡ This elaborates on the finding that medical market areas have "surgical signatures"; areas tend to have consistently higher than expected rates for some elective procedures and lower than expected rates for others.[6] Rates for a particular surgical procedure which are below the norm might tend to rise when a surgically active physician arrives in the area: procedures with above-normal rates might remain relatively stable after such an arrival. The reverse might happen in areas where such a physician departed; "above the norm" procedures would tend to drop in frequency toward the mean.

This formulation is relevant to several models of physician behavior. Both a "physician responding to the medical needs of the served population" model and a "chronic excess demand" model would be compatible with the pattern described above. The latter is based on the idea that medical services are subject to chronic excess demand, and care is rationed by physicians on the basis of severity of cases or provider interest in the cases.

Thus, if population demand for surgery were to exceed physician supply, then additional physicians would help take up this previously unfilled demand. Given surplus demand, physicians in the arrival areas could continue working at a high rate, unaffected by the new physicians. Since physicians in these areas are working close to capacity, the number of physicians would largely determine the rate. In departure areas, physicians try to take up some of the slack created when their surgically active colleagues depart or leave practice. Given their smaller surgical practices, these physicians are able to moderately expand their workloads. If rationing is taking place on the basis of case severity, movement toward the norms should occur as outlined above.

On the other hand, an "emulation" model would predict that a new active physician would tend to perform the same type of procedures done by his colleagues. Thus, the population rate for procedures being done at a rate above the provincial norm would tend to increase. Finally, a "physician discretion" model would predict that, on the arrival of a surgically active physician, changes in utilization of specific procedures would occur without regard to the previous surgical rate. This "physician discretion" model appears to fit the data better than models predicting movement toward or away from the norms. Five of the most frequently performed surgical procedures (D&C, cholecystectomy, hemorrhoidectomy, inguinal herniorrhaphy, and primary appendectomy) were studied. Each procedure in each type of area (arrival, departure, and control) was then categorized according to whether the before rate for a specific procedure was above or below the provincial norm and whether the before-after change represented an increase or decrease.

When surgical rates were below the Manitoba norm, no statistically significant differences in the probability of increasing were found between arrival and control areas. Likewise, a comparison of departure and control areas when rates were above the norm showed no such differences in the tendencies of such rates to decrease. Before year-arrival year comparisons were also made with similar results. Chi-

‡J. F. Fries, personal communication.

square tests characteristically did not approach statistical significance at the .05 level.

Physician Supply

The total number of physicians in an area, the number of operating physicians, and the number of physicians regularly operating (doing a minimum number of procedures annually) are several measures which might be used to describe physician supply. Precise physician supply figures are complicated to produce, given physician mobility and change of status during each year. As noted earlier, physicians doing surgery were assigned to areas on the basis of patient place of residence. Physicians not doing surgery were assigned to areas according to their residential postal code.‡‡

Table 4 presents physician supply figures for arrival, departure, and control areas for the year before any changes in supply took place.‡‡‡ Although Table 2 does suggest the departure of surgically active physicians from areas with low average workloads, supply figures are not closely associated with those for workload. For example, despite the differences in physician supply, year-before workloads in arrival areas averaged only four per cent more than year one workloads in control areas (Table 2). Manitoba figures on physician supply were correlated with beds/1000 and with surgical rate data for the same year. Correlations between physician supply (total MDs/1000 or operating MDs/1000) and surgical rates were low (about .22) but statistically significant for the 57 rural areas. Beds/1000 within each area was significantly correlated with the physician supply measures (in the .50 to .52 range) but not with surgical rates. A further small area analysis comparing operating MDs/1000 with surgical rates (using primary procedures rather than total surgery) for each of five years showed no consistent patterns. Correlations were generally not significant.

Discussion

The methods used here explicitly deal with some of the problems which plague correlational research relating manpower and operative rates. Because such studies have sometimes resulted in contradictory findings as to the importance of physician availability vis-a-vis ambulatory care, nonsurgical hospitalization, and surgery,[2,5,13] a different research design is particularly useful in addressing the issue. The before-after design of this study makes it unlikely that differences among areas are responsible for the findings on workload and utilization.*

The conceptual scheme employed is likely to influence the research findings. Because physician propensity to operate varies so greatly among individual doctors of the same specialty, counting numbers of physicians or numbers of surgical specialists misses much of what goes on. Because of this, correlating estimates of physician supply with surgical rates will generally produce only relatively weak results. A single surgically active physician can make a real difference to utilization within a small rural area.

Particular health system characteristics of rural Manitoba should be noted in connection with these results. First of all, the great majority of physicians in rural Manitoba are "opted in" to the health insurance scheme with no extra billing permitted. Fee schedules are determined by the medical association's bargaining with the province, and relative payments for different surgical procedures did not change during the period under study. Thus, fee schedules are insensitive to changes in local physician supply. Secondly, rural Manitoba has enjoyed a relatively generous bed supply and relatively low occupancy rates (generally around 65 per cent). Although the arrival, departure, and control areas differed in their bed supply, changes in this supply were not responsible for the changes in workload and utilization. Over the relevant years, mean supply in arrival areas varied from 6.80 to 6.53 beds per thousand; comparable figures in departure and control areas were from 8.76 to 8.82 beds per thousand and from 7.97 to 7.34 beds per thousand, respectively.

A "physician discretion model" seems to best explain the workload and utilization data. Several additional lines of evidence suggest the implausibility of using a "chronic excess demand" hypothesis to explain differences among areas. First of all, the Canadian national health insurance coverage, coupled with the fee-for-service system, might be expected to remove many of the financial barriers restraining this demand.

Second, survey data from both New England[8] and Manitoba[9] show relatively few differences between high and low surgical rate areas in population health status, access to health care, or such socioeconomic variables as education and ethnic background. Individuals in high rate areas do not seem to need or desire more health care than those in low rate areas.

Considerable within-country variation in surgical rates occurs across North America and Western Europe.[3,7] New England data indicate that surgical signatures remain relatively constant until a physician moves into or leaves an area.[6] The Manitoba data on workload and utilization strongly suggest that surgical signatures for small areas result from physician surgical preferences, not from patient characteristics.

‡‡A few conflicts occurred between the area assigned on one basis and that determined on the others; the number of procedures was generally the deciding criterion. If few procedures were involved, physician place of residence was used for assignment.

‡‡‡Even if a "physician months" figure were generated to deal with doctors who start practice, retire, move, and die, the problem of physicians dividing their practice among several service areas would still be present. Practice in rural Manitoba is such that relatively few physicians operate on a significant number of patients from outside the home area. Although the physician counts are based on home area with no computation of "fractions of physicians," counts using other assumptions were highly correlated (in the mid .90s) with those presented here. Finally, efforts to distinguish between full-time and part-time physicians produced only minor differences in physician supply. Research in British Columbia has also found relative supply figures largely insensitive to this distinction (R. G. Evans, personal communication).

*Cross-sectional studies of these relationships may produce inconsistent results because of differences in handling border-crossing, in the size of areas, in population selection criteria, and so forth.

Our findings, taken in conjunction with procedure-specific variations in practice patterns found within countries with differing surgical rates, point up the inadequacy of an "unfilled demand" explanation.[6,7,14] Given the ranges of physician supply prevailing in fee-for-service systems within North America, physicians appear to have great discretion in determining their own surgical practice patterns. Mean surgical workloads have been found to be fairly low in both the United States[15] and Manitoba;[16] expansion of such workloads is often an option for the physician. On the other hand, workloads appear slow to move downward; the arrival of surgically active physicians seems to lead to increased utilization. With widespread uncertainty as to the efficacy of common surgical procedures, differences in physician propensity to operate are translated into variation in both overall surgical rates and rates of various operative procedures.

REFERENCES

1. Reinhardt UE: The physician as generator of health care costs. *In:* Health Care in the American Economy: Issues and Forecasts, 1978. Chicago: Health Services Foundation, 1979.
2. Pauly MV: Doctors and Their Workshops: Economic Models of Physicians' Behavior. Chicago: University of Chicago Press, 1980.
3. McPherson K, Strong PM, Epstein A, Jones L: Regional variations in the use of common surgical procedures; within and between England and Wales, Canada and the United States of America. Soc Sci and Med 1981; 15a:273–288.
4. Vayda E, Anderson CD: Comparison of provincial surgical rates in 1968. Can J Surg 1975; 18:18–26.
5. Mitchell JM, Cromwell J: Physician-induced demand for surgical operations. Chestnut Hill, MA: Center for Health Economics Research, 1980.
6. Wennberg JE, Gittelsohn A: Small area variation in health care delivery. Sci Amer 1982; 246:120–134.
7. McPherson K, Clifford P, Wennberg JE, Hovind OB: Small area variations in the use of discretionary surgery: an international comparison between New England, England and Norway. Oxford: Department of Community Medicine and General Practice, Oxford University, 1981.
8. Wennberg JE, Fowler FJ: A test of consumer contribution to small area variations in health care delivery. J Maine Med Assoc 1977; 68:275–279.
9. Roos NP, Roos LL: High and low surgical rates: risk factors for area residents. Am J Public Health 1981; 71:591–600.
10. Hughes EFX, Fuchs VR, Jacoby JE, Lewit EM: Surgical work loads in a community practice. Surgery 1972; 71:315–327.
11. Cook TD, Campbell DT: Quasi-Experimentation. Chicago: Rand McNally, 1979.
12. Roos LL, Roos NP, Cageorge SM, Nicol JP: How good are the data? reliability of one health care data bank. Med Care 1982; 20:266–276.
13. Fuchs V: The supply of surgeons and the demand for surgical operations. J Hum Res (Supplement) 1978; 13:35–56.
14. Bloor MJ, Venters GA, Samphier ML: Geographic variation in the incidence of operations on the tonsils and adenoids: an epidemiological and sociological investigation. J Laryn Otol 1978; 92:791–801, 883–895.
15. Nickerson RJ, Theodore C, Peterson OL, *et al*: Doctors who perform operations: a study on inhospital surgery in four diverse geographic areas. N Engl J Med 1976; 295:921–926, 982–989.
16. Roos LL, Cageorge SM: Surgical workloads in Manitoba. Winnipeg: Faculty of Administrative Studies, University of Manitoba, 1981.

ACKNOWLEDGMENTS

The author gratefully acknowledges the help of the Manitoba Health Services Commission with this research. This research was supported by National Health Research and Development Project No. 6607-1197-44, as well as by Research Scholar Award No. 6606-48 from Health and Welfare, Canada. Interpretations and viewpoints contained in this paper are the author's own and do not necessarily represent the opinion of either the Manitoba Health Services Commission or Health and Welfare, Canada. The author would also like to thank J. P. Bunker, R. G. Evans, J. F. Fries, and J. E. Wennberg for their comments on this study.

National Student Nurses' Association 1983 Convention

The 1983 Convention of the National Nurses' Association will be held April 6–10, 1983, at the Baltimore, Maryland Convention Center. "Breakthrough to the Future" is the theme of the convention.

Sponsored by the American Journal of Nursing Company, the convention will include discussions on the future impact nursing can have and the involvement of students in determining nursing's future.

For more information, contact Barbara Jo Nerone, APR, National Student Nurses' Association, Inc., 10 Columbus Circle, Room 2330, New York, NY 10019. Telephone 212/581-2211.